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(21) International Application Number: PCT/SE00/00332 (22) International Filing Date: 18 February 2000 (18.02.00) (30) Priority Data: 9900623-1 22 February 1999 (22.02.99) SE (71) Applicant (for all designated States except US): TELEFON-AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): BERGQVIST, Erik [SE/SE]; Ungrik 4906, S-820 70 Bergsjö (SE). OLSSON, Bertil [SE/SE]; Sägbäcksvägen 18, S-820 64 Näsviken (SE). (74) Agent: ERICSSON MICROELECTRONICS AB; Department for Intellectual Property Rights, S-164 81 Kista-Stockholm (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: A FIBRE FEEDING DEVICE <div data-bbox="438 1134 1136 1617" data-label="Image"> </div> (57) Abstract <p>The present invention relates to a device for feeding optical fibres into a tubular element, duct, or the like. For ease of handling, the fibre feeding device includes a channel (26) into which there can be inserted a bar (22) which includes one or more longitudinally extending blow passages (29), where each passage has a cross-section that is adapted to a given type of optical fibre. Holes (25, 27) are provided in the bottom surface of the channel close to its respective rear and front edges, for delivering and removing compressed air used to advance the optical fibre. With the optical fibre placed in the blow passage in the bar, the optical fibre in said passage will be advanced when compressed air is delivered through the holes in the rear edge of the bar, by virtue of the blow passage functioning as a Venturi tube where a leakage flow exerts an ejector effect on the optical fibre to promote advancement of said fibre through the blow passage.</p>		

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A FIBRE FEEDING DEVICE**FIELD OF INVENTION**

5 The present invention relates to a fibre feeding device for feeding optical fibres into a tubular element or into some corresponding element, either singly, loosely or closely connected together, this latter being preferred.

10 **DESCRIPTION OF THE BACKGROUND ART**

It is known to install optical fibres by means of a blowing technique. In order to allow an optical fibre or several optical fibres contained in an optical fibre ribbon to be
15 blown into a tubular element, duct, or the like, it is essential that the friction between the optical fibre or fibre ribbon and the inner surface of the tubular element is very low, that the presence of static electricity is negligible, and that the air resistance is sufficiently large
20 to enable the optical fibre(s) or fibre ribbon to be advanced even at moderate air propulsion speeds. Hitherto, the solution to this problem has been achieved by applying to the optical fibre(s) 1 or to the optical fibre ribbon a diameter-increasing layer 2 that includes friction reducing material.
25 In the case of mutually combined or closely connected optical fibres 3, 4, several of these fibre combinations have been orientated in a rotational-symmetrical bundle so as to have the same flexural resistance in all planes, and have been provided with a diameter-increasing layer 5, 6 of glass
30 beads, for instance. In order to be able to use optical fibre ribbon techniques 7-9 and utilise the advantages that this would afford in respect of welding and the establishment of

electrical contacts without requiring additional material for rounding the cross-section of the ribbon, and for reducing friction and increasing air resistance, a thin Kevlar® wire or filament 10 may be wound around the optical fibre ribbon.

5 This wire can be readily removed at the ends of the optical fibres at a later time, when the ends are to be welded or when electrical connections shall be established. See Figures 1A-G.

10 When an optical fibre 11 or an optical fibre ribbon shall be fed into a tubular element, e.g. ducting, with the aid of compressed air, the optical fibre or ribbon is fed by an optical fibre feeding device into a pressurised space 12 that is connected to the tubular element into which the optical
15 fibre shall be blown. In so doing, it is necessary to apply some form of force that will overcome the backward ejection force acting on the optical fibre in a direction opposite to the feed direction. This has been achieved in the case of several systems, by allowing the optical fibre 11 to pass
20 between two feed rollers 14, 15 that have a soft surface coating. These rollers or wheels may be electrically operated, although they may also conceivably be operated by the pressured air used to propel the optical fibre, so as not to damage the fibre should it be prevented from moving along
25 the duct for some reason or other. A pressure sensor 16 may be provided in the space 12 so as to detect any pressure changes that would result from forward movement of the fibre through the duct being prevented. An optical fibre feeding device designed to operate in accordance with this fibre
30 feeding technique would be relatively complicated and would also require the supply of electrical energy in addition to

the compressed air supply for propelling the optical fibre.
See Figure 2.

5 The aforesaid backward ejection force in the duct can be partially overcome with the aid of an ejector effect generated by the compressed air 17 supplied, by allowing a leakage flow 18 to pass through an optical fibre blow pipe 19 that is designed to function as a Venturi tube, where the air velocity is high and the pressure is low. The blow pipe may
10 be provided with adjustable outlet valves 20 on the downstream side, for controlling the leakage flow. In this way, the optical fibre or fibre ribbon is subjected to an additional propulsion force when introduced into the blow pipe. The leakage flow results in a lower pressure in the
15 blow pipe, a factor which may allow the blow length to be reduced. See Figure 3.

SUMMARY OF THE INVENTION

20 With the intention of simplifying handling of an optical fibre feeding device that includes a blowing passage for feeding one or more optical fibres into a tubular element, duct or the like, the blow passage can be opened to allow different types of optical fibres to be fed thereinto. The
25 optical fibre feeding device comprises a body that includes a groove or channel into which there can be inserted a bar that includes one or more longitudinally extending blow passages, where the cross-section of each passage is adapted for a given type of optical fibre. Holes for delivering and
30 removing compressed air used to propel the optical fibre(s) are provided in the bottom surface of the groove or channel in the close proximity of its respective rear and front

edges. With an optical fibre placed in the blow passage and with the bar placed in the groove/channel in the body of said device, the optical fibre will be propelled forwards when compressed air is delivered through the holes at the rear edge of the groove/channel, by virtue of the blow passage functioning in the manner of a Venturi tube, wherewith a small leakage flow in the blow passage will cause transportation of the optical fibre through the fibre feeding device and into a blow pipe through the medium of an ejector effect. Because the bar is removable and is provided with grooves or channels of mutually different sizes, the fibre feeding device can be used for different types of optical fibres and also enables optical fibres that have already been connected electrically to be fed into the tubular element or duct. According to the invention, the blow passages may be given a rectangular cross-section, so as to enable a non-rounded optical fibre ribbon to be blown into the tubular element or duct by means of the fibre feeding device.

The invention will now be described in more detail with reference to a preferred embodiment thereof and also with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A-G illustrate conventional optical fibres whose surfaces include friction reducing means and/or air resistance increasing means, and an encased optical fibre ribbon.

Figure 2 illustrates an optical fibre feeding device.

Figure 3 illustrates the principle of advancing optical fibres with the aid of a Venturi technique.

Figures 4A-C illustrate an inventive optical fibre feeding device, including two cross-sectional views.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 4A-C illustrate schematically an inventive optical fibre feeding device 21 that includes a removable bar 22 for in-feeding different types of optical fibre ribbons 23. The device includes an adjustable compressed-air connection 24 in the form of a pistol grip which is connected to one end of the fibre feeding device. This compressed air connection enables compressed air to be delivered to one or more holes 25 at one end of the bottom surface of a passage 26 in the feed device. One or more holes 27, which may optionally be adjustable, are provided at the other end of said passage and connected with a region outside said device for evacuating air therefrom. The bar 22 has an essentially square cross-sectional shape and can be inserted into the passage 26 in the body 28 of said device and includes on at least one long side a groove 29 which is intended to function as a blow passage or channel for an inserted optical fibre when the bar is placed in the body of said device. In this regard, the cross-section of the blow passage 29 is adapted to fit a specific optical fibre or optical fibre ribbon for advancement of the fibre or ribbon with the bar placed in said body. The upper side of the body 28 includes threaded holes 30, 31 which coact with at least two tightening screws 32, 33 for securing the bar 22 in the passage/channel 26. The screws enable the position of the passage/channel in the body

to be adjusted, i.e. the blow passage can be opened for insertion of an optical fibre ribbon or closed for forward feeding of said ribbon. In the illustrated case, the device includes a spring 34 positioned between bar and body for simplifying handling of the optical fibre, by enabling the bar to be lifted away from its abutment surface with a spring force and an optical fibre to be easily removed from or placed into the blow passage. An optical fibre blow pipe 35 can then be readily connected to the fibre feeding device, by clamping the pipe firmly between the body 28 and the bar 22. Bars that include blow passages of mutually different cross-sections can be used with one and the same body, therewith enabling ribbons/cables of mutually different cross-sections to be fed into the tubular element/duct by means of the inventive device.

The installation of optical fibres can be further simplified by providing the fibre feeding device with a simple holding means in the form of a collapsible arm 36 for supporting a drum 37 or the like on which optical fibres have been wound. When an inventive optical fibre feeding device is connected to a drum that carries optical fibres, optical fibres can easily be installed by one single person. The inventive fibre feeding device also enables optical fibre cables that have already been connected electrically to be fed into a tubular element/duct in predetermined lengths, wherewith the bar is raised to expose the blow passage when the electrical connection is located on the front end of the cable. When the electrical connection is located on the rear end of the cable, this end of the cable can be supported by the drum together with an optical fibre cable/ribbon of given length. When the optical fibre cable has been fed into the blow pipe,

there is immediately obtained an established optical fibre connection that can be connected directly to an existing outlet, such as a wall outlet in a living space.

5 The arm 36 holding the drum 37 may be provided with a recording device 38 which records the length of optical fibre that has been blown into the duct. The device 38 may, for instance, function to optically register a mark on one side of the drum so as to determine the number of revolutions of
10 the drum when taking optical fibre therefrom and therewith the length of optical fibre unwound from the drum. The arm may also carry a compressed air-driven brake means 39 which functions to stop the drum should feeding of the optical fibre be stopped for some reason or other. The brake means
15 may be activated in response to a pressure change occurring in the blow passage when the optical fibre is unable to move forwards.

It will be understood that the invention is not restricted to
20 the aforescribed and illustrated exemplifying embodiments thereof and that modifications can be made within the scope of the accompanying Claims.

CLAIMS

1. A device for feeding optical fibres into a tubular element, duct, or the like, comprising a compressed air-operated feeder in which an optical fibre is advanced with the aid of compressed air delivered to a passageway in the feeder in which the optical fibre is located, **characterised** in that the device includes a bar (22) which has at least one blow passage (29) and which can be inserted into and fixed in a channel (26) in a body (28) of said device, wherein said channel includes holes (25, 27) for the delivery and removal of compressed air; in that the blow passage (29) has a cross-sectional shape that is adapted to a given type of optical fibre or fibre ribbon, such that optical fibres of mutually different cross-sections can be fed into said tubular element with the aid of one and the same optical fibre feeding device, depending on the setting of the bar (22).
2. A device according to Claim 1, **characterised** in that the bar (22) has a generally square cross-section.
3. A device according to Claim 1, **characterised** in that the body (28) of said device includes means (30-33) for releasing and fixing said bar.
4. A device according to Claim 1, **characterised** by a spring mechanism (34) disposed between body (28) and bar (22) for releasing the bar from its fixed position.
5. A device according to Claim 1, **characterised** by an optical fibre carrying drum (37) which is connected to the feed device by means of an arm (36), wherewith optical fibre

coiled on the drum can be delivered directly to the fibre feeding device.

5 6. A device according to Claim 5, characterised by means (38) for recording rotational movement of the drum (37), so as to enable the number of optical fibre turns unwound from the drum to be recorded.

10 7. A device according to Claim 5, characterised by brake means (39) for stopping rotation of the drum (37).

15 8. A device according to Claim 7, characterised in that said brake means (39) is driven by compressed air and controllable, so that rotation of the drum (37) can be stopped in response to pressure changes in the blow passage (29).

1/2

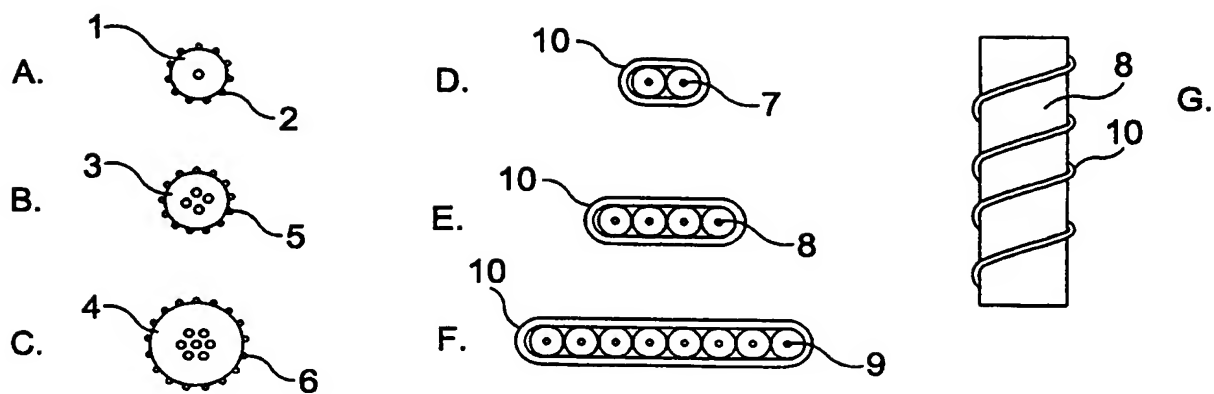


Fig. 1

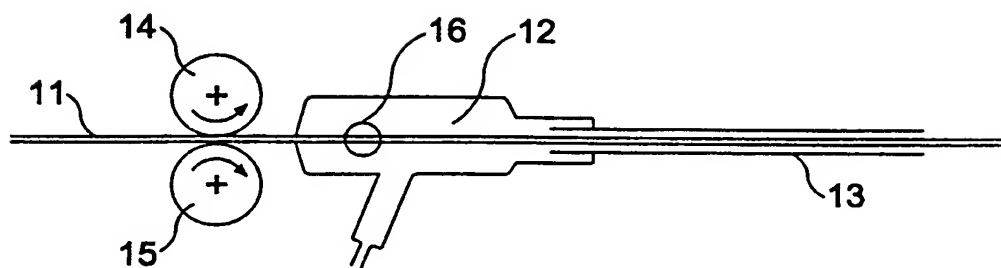


Fig. 2

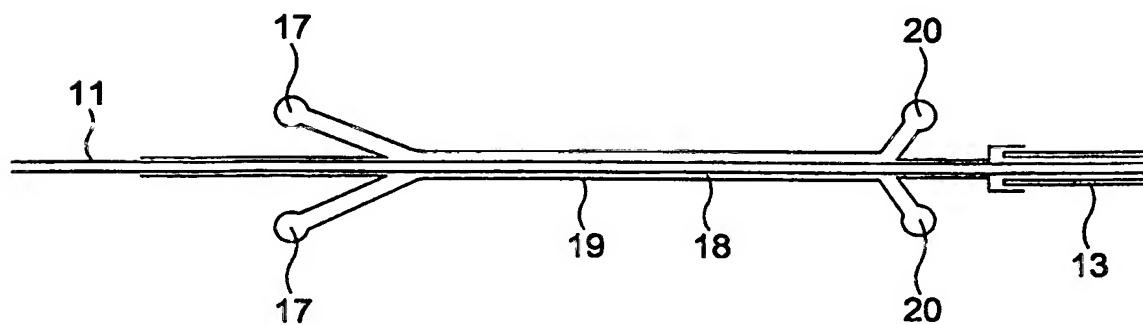


Fig. 3

2/2

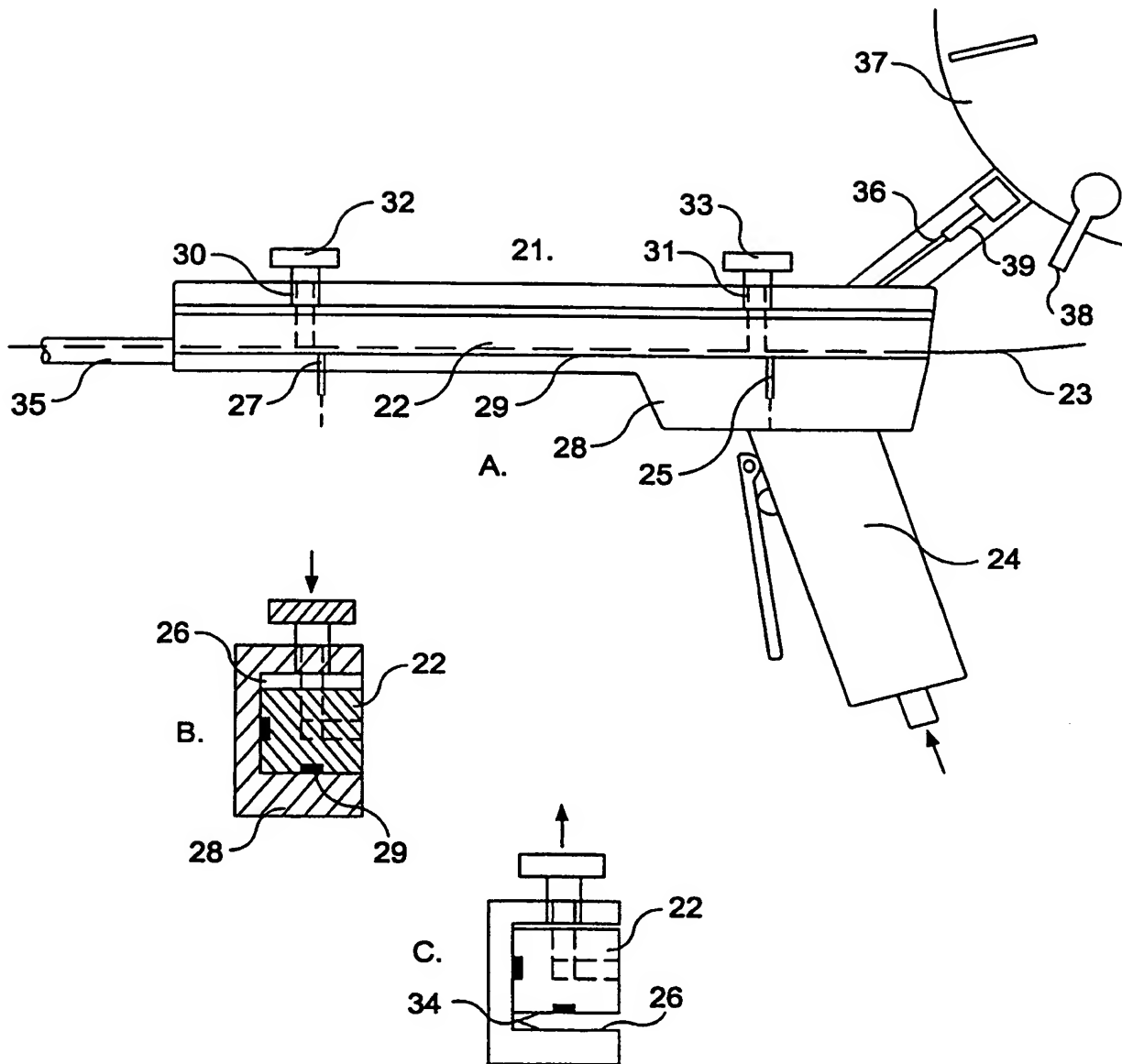


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00332

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G02B 6/52

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2207562 A (BICC PUBLIC LIMITED COMPANY), 1 February 1989 (01.02.89) --	1
A	EP 0508016 A1 (TOA KIKAI KOGYO CO., LTD.), 14 October 1992 (14.10.92) -- -----	1

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
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Patent document cited in search report			Publication date	Patent family member(s)	Publication date
GB	2207562	A	01/02/89	NONE	
EP	0508016	A1	14/10/92	AU 643554 B	18/11/93
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